Perceptions and Use of Gerotechnology: Implications for Aging in Place

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ABSTRACT. Understanding perceptions and use of gerotechnology is crucial to optimize design, application, and education strategies that may reduce caregiver burden, extend healthy aging in place, and minimize demands on the health care system. A pilot project was conducted to explore attitudes, opinions, and preferences of older adults concerning the use of technology to support and extend their ability to "aging in place." Four major themes emerged as important for older adults to age in place: safety and independence, social interaction, use of technology in the past, and the desire for support. Based on the literature in gerotechnology and the pilot study findings, we present a conceptual model that integrates gerotechnology into the life span theory of control (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996) and the concept of aging in place.

KEYWORDS. Gerotechnology, aging in place, Life Span Theory of Control, congruence model of person environment interaction

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The 2000 Census projected an increase in the 65-and-over population in the next quarter century due to the aging of the baby boom generation (people born between 1946–1964) who will begin turning 65 in less than a decade. Older adults almost uniformly prefer to *age in place*; that is, living in one’s own dwelling after retirement (AARP, 2003; ASID, 2003). Strong evidence suggests that older adults have significantly improved quality of life, social connectedness to family and friends, and fewer health-care complaints when they are able to live safely in their own homes, rather than in institutional settings (Fogel, 1992; Sixsmith, 1990; Tilson, 1989). Although most existing homes do not readily accommodate the changing needs of their aging residents, many older adults continue to reside in their own homes, often alone. The assistance they need is provided most often by informal family caregivers (Grant et al., 2004) who frequently experience significant stress while juggling multiple roles in addition to their caregiving duties (Zarit, Reever, & Bach-Peterson, 1980).

In this aging society, there is evidence that technological advancements could help older adults (especially those living alone) to live independently and alleviate the pressures on their caregivers (Dishman, 2004; Dishman, Matthews, & Dunbar-Jacob, 2003). This type of technology is often referred to as “gerotechnology” in academic literature. Many gerotechnologies are already available and many more innovative devices are introduced to the market each year.

The drive for the development of gerotechnologies is fueled by the desire of older adults to *age in place*, coupled with their increasing need for assistance in daily activities. Proponents of gerotechnologies (e.g., Dishman 2003; Dishman et al., 2003; Fozard, Rietsema, Bouma, & Graafmans, 2000; Horgas & Abowd, 2003) argue that gerotechnologies such as activity monitoring devices and advanced communication interfaces can both reduce caregiver work load and reduce demands on the health care system. For example, remote monitoring technology allows caregivers to track an older person’s activity. Networks of environmental sensors can determine location and movement and can monitor sleep patterns. In addition to emergency response, detecting deviations from normal patterns may lead to earlier and more effective interventions (Kutzig & Glascock, 2004; Tran, 2004). However, some researchers (e.g. Rogers, Mayhorn, & Fisk, 2004) caution that these same technologies may actually impair quality of life. There may be perceived or actual compromise of privacy for both parties, and they may even increase older adults’ feelings of isolation if there is
a reduction in face-to-face interaction. Moreover, caregivers may be burdened by information overload or by issues of accessibility. Some effects of gerotechnology may be unanticipated, and it is likely that an entirely different pattern than those discovered for more conventional devices will emerge (Cheek, Nikpour, & Nowlin, 2005; Harke, Prohaska, & Furner, 1998). Understanding perceptions and use of gerotechnology is crucial to optimize design, application and education strategies regarding emerging gerotechnologies that may reduce caregiver burden, extend healthy aging in place and minimize demand on the health care system. In this article, we first provide an overview of the literature on advantages and disadvantages (perceived or empirically demonstrated) of gerotechnology. Second, we present findings from a pilot project that explores attitudes, opinions, and preferences of older adults concerning the use of technology to support and extend aging in place. Finally, we present a conceptual model that integrates gerotechnology into the Life Span Theory of Control (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996) and the concept of aging in place.

TECHNOLOGY AND AGING LITERATURE

The Role of Gerotechnology in Aging in Place: Older Adults’ Use of New Technologies

It is estimated that 33 percent of people 50 and over use some type of special equipment or assistive technology (Forrester, 2003). Research suggests that assistive technology increases the independence of older persons and can slow the loss of functional abilities among frail elders (Forrester, 2003). Other studies have documented that assistive technology can improve the safety of older adults by preventing injury and increasing home security (Seiler, 2004). Meyer and Mollenkopf (2003) found that older adults believe that technology can improve their lives and that they have high expectations of a “smart” home’s ability to improve security and reduce energy consumption. However, some older adults also expressed concern that technology may be too complicated to use. Further, older people with higher education and income and those who have a partner are more likely to use technologies of any kind, compared to older people who are single and have a lower socio-economic background. Levy, Bradley, Morison, Swanston and Harvey (2002) found that older adults’ positive attitudes towards video-linked remote health consultation, or “telecare.”
were related to age, home ownership, dwelling type and household composition.

Older adults are the fastest growing segment of the population in the use of e-mail (Quadagno, 2005). By 2010 there will be 2.5 times as many adults over the age of 65 who use computers as there are today (Forrester, 2003). This growth comes from two areas: an increase in the total number of people in the older adult category and in greater use of computers by older individuals. D. McConatha, J. McConatha, and Dermigny (1994) demonstrated that older adults frequently use on-line services, including email, games and puzzles, consumer reports, educational items, bulletin boards and stock market reports. These trends highlight the desire and ability of older persons to embrace technology.

A significant body of literature highlights the importance of the home environment in supporting competencies and quality of life for people as they age. Wahl (2001) conducted a comprehensive review of literature in aging and environment that showcased Lawton’s Ecological Theory of Aging–Competency-Environment Model (1981, 1998; Lawton & Nahemow, 1973). A central tenet of Lawton’s model is that as a person’s competencies decline, the demand structure of the environment becomes increasingly imposing, resulting in a high potential for negative adaptive outcomes. This model provides clear justification for modifying the home (including technological aides) to adjust imbalances.

The American Association of Homes and Services for the Aging (AAHSA) created the Center for Aging Services Technologies in 2003 to address the ways technology may be employed to meet the challenges of increase in older adult population in the U.S. The National Institute of Aging sponsored workshops on applications of technology to the needs of aging population (Pew & Van Hemel, 2003). A strong directive of both of these ventures is the crucial need for social science research to accompany the fast-paced development of technology. Although these workshops and organizational efforts provide evidence that emergent technologies have applications for older adults, empirical research in this area is limited.

**Perceptions and Adoption Characteristics of Technology: Older Adult Care Recipients**

Research demonstrates that multidimensional factors are related to use of new technology by older adults. Gitlin (1995) in her research on the frequency of use of assistive technology, found that use of such technologies
was affected by personal characteristics such as perceived need, functional status, and personal evaluations of disability and devices; socio-spatial and cultural context; and the characteristics of the technology/device such as its aesthetic quality, durability, ease of use and fit with the person and environment. It is important to note that neither age nor gender was shown to be influential in the use of assistive technology. In addition, McCreadie and Tinker (2005) discovered that chronological age was less important than felt need. These findings break stereotypical beliefs that older adults resist the adoption of new technologies.

Along with age, research has demonstrated that cohort is another factor that can influence the decision to use technologies. Socio-historical experiences and time of measurement significantly influence outcomes for each cohort (Goldhaber, 2000). For cohorts not exposed to technology prior to retirement, perceptions may involve misconceptions, prejudices, and incorrect or insufficient knowledge about the technology (Melenhorst, 2002). Each cohort has different attitudes towards the use of technology. For example, the advent of new technology in the 1990s might have differential influence on people from different cohorts. People who were not retired during the 1990s were probably more likely to be exposed to new developing technologies than people who were already retired at that time; therefore, it would be expected that the former group will be more open to the use of technologies. Zimmer and Chappell (1999) examined cohort and related factors such as education, income, age, rural residence, gender, home ownership, and VCR ownership to identify older adults’ receptivity to technology. Younger individuals with more education and living in urban areas had perceptions that the technology could be helpful. However, home ownership, income level, and previous ownership of technology (i.e. VCR) did not have direct effects on receptivity to technology. Luborsky (1993) highlighted the need for understanding social, cultural, and ethical differences in older adults’ acceptance and use of technology and noted that their acceptance is affected by culture and personal biography.

Motivation and the Use of Technology

Another factor that requires focused attention is how motivation influences the use of technology. Research indicates there are two stages of user motivation, “felt-need” and perceived benefits of the technology (McCreadie & Tinker, 2005; Melenhorst, Rogers, & Caylor, 2001). Prior to acceptance of new technology, a person needing health or personal care at
home must establish whether or not he/she feels a need or has an actual physical or cognitive need that could benefit from using the technology. Motivation for primary control can be an important factor in an older adult’s decision to use technologies (Schulz & Heckhausen, 1996). If an older adult is strongly determined to live independently despite his/her deficiencies, motivation is likely to be high to find ways to achieve that goal. McCreadie and Tinker (2005) state that, “the assessment of objective need has to be balanced by reference to the individual’s perception of his or her own needs” (p.105). Zimmer and Chappell (1999) indicate that perceived poor health can stimulate a need for technology to improve independence. Additionally, problems in the layout and design of the residence can influence the acceptance of new technological devices.

Other factors that influence adoption of technologies in the home by older adult care recipients are perceived presence or lack of benefits (Melenhorst, Rogers, & Caylor, 2001). Melenhorst (2002) examined care recipients’ adoption of communication devices and identified that the two main factors in influencing adoption decisions were the desirability and attainability (i.e. cost benefit) of the technology. Mann, Belchior, Tomita, and Kemp (2005) found that non-computer users were interested in using a computer and high speed internet service, but perceived cost as a barrier.

**Familiarity and the Adoption of Technology**

Familiarity is another important variable in technology adoption by older adults. Menachemi, Burke, and Ayers (2004) explored older adult care recipients’ perspective of telemedicine and indicated that perceived feelings of security, vulnerability, privacy and confidentiality fostered reluctance to use the technology. On the other hand, care recipients were more willing to adopt telemedicine technology if the equipment included familiar technologies such as cable lines, standard telephone, and a home computer. The familiarity of the technology assisted in positive adoption after receivers were given time and “reeducation” to adapt to the new use of the familiar technologies (Menachemi, Burke, & Ayers, 2004, p. 627). McCreadie and Tinker (2005) addressed the issue of radical home alterations done to accommodate assistive technology and the subsequent care recipients’ changing relationship to home. Familiarity with the objects added to the home is an essential element for acceptability; however certain care situations and/or new technological innovations require unfamiliar technology implementation. The desire to remain in the home must be strong
if substantial home alterations cause discontinuity in care recipients’ sense of home, individuality, comfort and homeliness.

Perceived Advantages and Disadvantages of Technology Use

Menachemi, Burke, and Ayers (2004) found that relative advantages for care recipients using telemedicine included: (1) satisfaction with speed of information turnaround; (2) reduced travel time and expense for both care recipient and caregiver through video interaction with a physician; and (3) feeling more secure when living alone. Privacy, social integration and intrusiveness were not problematic for participants in Sixsmith’s (2000) research on telecare and intelligent home monitoring, although some of Sixsmith’s (2000) participants were concerned the technology would replace access to “human based services” (p. 71). The concern of losing access to human services and/or human interaction requires additional research since the studies indicate that many older adults require human based assistance to implement and/or use the technology. A case study completed by Hanson, Magnusson, Oscarsson, and Nolan (2002) explored the household of an older adult female care recipient (wife) and older adult male caregiver (husband) and their opinions of information and communication technology in the home. The technology boosted the care-receiver’s self-confidence and sense of security through enabling her to seek medical information online and establish new social contacts. Additionally, the care receiver’s new “insights into her own condition” fostered an “enhanced awareness of others” which improved the couple’s relationship and allowed the caregiver more individual time to pursue his hobby (p. 869). This case study included an outside third party, a technical support worker who assisted with learning and using the technology. Because the couple relied heavily on his knowledge and expertise the research indicates this individual’s involvement was instrumental in successful implementation. Mann et al. (2005) confirm that older adult users in general require assistance on computer use from family, friends, neighbors or technical support professionals. For users with impairments, there was an increased need for professional assistance with the appropriate technology.

The expense of technology is an issue that must be considered. Several participants in Sixsmith’s study (2000) were concerned with the cost of monthly service for telecare in the home. On the other hand, Melenhorst, Rogers, and Bouwhuis (2006) found that older adults made both positive and negative decisions about new technology based on performance benefits and not on costs. Conversely, decisions regarding traditional media
were based on both benefits and costs. Ultimately, Melenhorst, Rogers, and Bouwhuis (2006) conclude that older adults will spend energy and money on a new technology as long as it is perceived valuable. In summary, the perceived advantages and disadvantages are multidimensional; however, a consistent theme revolves around perceived needs and perceived benefits.

The discussion above demonstrates that multidimensional factors (including personal characteristics, sociocultural context, physical environmental factors, motivation, cohort effect) in various combinations may influence older adults' perceptions of gerotechnology and their decision to use it. In the following section, we provide preliminary findings from a pilot study that has guided the development of the conceptual model presented in the final section of this article.

**PILOT STUDY FINDINGS**

*Highlight of Findings from a Pilot Study on Older Adults’ Perceptions of Gerotechnology*

The aim of this paper is generation of a conceptual model that incorporates gerotechnology as a compensatory mechanism in the person-environment interaction to facilitate aging in place. The model is discussed in a following section. This model is primarily based on integration of the key concepts from the current literature. However, our research team is conducting a series of small pilot studies with older adults living in their own homes and in assisted living facilities, in both urban and rural areas of Oregon. The preliminary data analysis of our first focus group session revealed useful concepts for the model generation. We highlight some of these emerging themes from that session.

Research questions that guided these pilot projects were as follows:

- How do older adults perceive use of technology?
- What factors influence older adults’ perceptions about use of communication and monitoring technology?

**Description of the Pilot Study**

We investigated attitudes, opinions, and preferences of technologies that have the potential to enhance older adults’ safety, health, social interaction, and sense of independence with a group of older adults living
in a not-for-profit assisted living facility in Oregon. Data were collected with a small sample of nine cognitively intact older adult residents (age 70 years or older, 7 females and 2 males, all non-Hispanic whites). Two scenarios in the form of short video clips were presented as discussion stimuli to help participants understand the potential of communication and monitoring technology. The first video clip was from *Star Trek* and demonstrated the potential of personal communication devices. The second video clip was from *Harry Potter* and introduced the idea of monitoring technologies, showing the movement of people as footprints on a floor plan. The interview focused on participants’ perceptions and concerns regarding these technologies. After each scenario was shown, participants were asked their views about the use of technologies to support *aging in place*. To begin, we asked participants to think about the circumstances that led to their decision to enter assisted living. Questions that guided the subsequent discussion were as follows: What issues and concerns do you think you encounter in living independently? What kinds of assistance were most needed? What do you think about these (communication and monitoring) devices (demonstrated during the scenario presentation)? Would you like to have access to this kind of technology? Who would you talk to with this device (communication technology)? Who should have access to such information (your movements in the screen; monitoring technology)? What problems can you see with this kind of technology?

Four major themes emerged from the focus group interviews related to gerotechnology issues: safety (number of mention \[n\] = 54), social interactions \( (n = 25) \), use of technology \( (n = 22) \) and support \( (n = 15) \). Three additional themes—health, finance, and privacy—though not directly linked to technology by the participants, were also identified as important to them. In this paper, we discuss the top four themes: safety, social interaction, use of technology, and support. The following Table 1 provides a list of the frequency for each theme.

Safety, especially related to falling, was the main concern of the participants. Most participants seemed to have a fear of falling and were concerned about how they could get help if they fall. Throughout this discussion, participants often mentioned their experiences about falling; they described accidents in which their friends or neighbors fell down and received help from professionals. For example, John, mentioned,

Breaking a leg, maybe never being able to walk again. That’s one of our biggest concerns. Then if we fall, how soon will it be before we get help.
TABLE 1. Frequency for Each Theme in Perception from the Pilot Study

<table>
<thead>
<tr>
<th>Themes</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Safety and Independence</td>
<td>54</td>
</tr>
<tr>
<td>Social Interaction</td>
<td>25</td>
</tr>
<tr>
<td>Use of Technology</td>
<td>22</td>
</tr>
<tr>
<td>Support</td>
<td>15</td>
</tr>
<tr>
<td>Health</td>
<td>9</td>
</tr>
<tr>
<td>Finance</td>
<td>8</td>
</tr>
<tr>
<td>Privacy</td>
<td>3</td>
</tr>
</tbody>
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Also, Megan, a female participant, talked about her experience,

I think I would have had to move anyway because I fell, called 911 three different times and they came right out and picked me up off the floor and the last time I fell I told my daughter I said I have to get out of here. I can't stay here another day longer. I said I don't care where I go but I have to get out.

Because of the fear of falling, a primary focus was on technological devices that could provide immediate emergency response. For example, when they saw the video clip of a high-tech communication device, the participants shared their experiences of someone falling and emphasized that a calling pendant or similar types of emergency calling devices were very helpful for older adults in this situation. John mentioned a badge,

I know a lot of people that have had those in their homes... I had one girlfriend that had the badge and she fell and couldn't get up. She pressed the button and they came right out and got her off the floor and she was fine. She wouldn't have been able to get up. She would have been there all night, so it helps a lot.

Social interaction is another central theme for the participants. Interacting with other people is crucial for their well-being. For example, one participant mentioned the importance of social interactions in the assisted living facility, while another emphasized that the residents consider themselves a family. According to Chris,
I think the sociability of a place like this really important too. Rather than being alone why you have a number of close neighbors any of them can be friends and you know it's very nice to have a sociable group of people.

This means that the participants might have developed a new way of family life in the facility, which is different from their own families; they receive emotional support from their community. They want to be independent and enjoy interacting and supporting each other in the facility. The responses indicated that the participants prefer professionals to watch their movements using a monitoring technology, rather than burdening their family members. This may be related to the fact that they had already moved away from their family and saw the facility staff as their primary caregivers. Chris mentioned,

I could see it you know applied to an apartment house like this where that information for each apartment could come into a central screen, so that the caregiver could see any problems in the apartment every night.

Another woman explained her experience of moving out of her house; she felt she had to move to the retirement facility because she had fallen three times and realized that she could not live by herself anymore. She emphasized that she had renovated the house to meet her physical needs, but could only stay there for a short time. In order to live safely and independently in the community, participants are willing to use communication and monitoring technologies. These devices might provide reassurance even if activated only for unexpected falling accidents and other emergency situations.

Support is another theme that participants frequently brought up. This theme is also related to issues for safety, falling, and independence. When they talked about getting help, they always mentioned their experiences of falling. Receiving support is very important to the participants, especially when they fall. Furthermore, it seems that they would prefer to receive help from professionals rather than family members. Chris mentioned,

One very nice thing is that it takes a lot worry off your family's mind. You know people worry about old folks living by themselves and when you move in here you are not by yourself anymore and you
have plenty of help available and your kids don’t have to worry about you.

The participants were mainly concerned about safety and independence. In order to be safe and independent, they acknowledged the usefulness of technological devices and the importance of social interactions. Participants expressed their wish to age safely and successfully in the community. They were aware of potential uses for technology to help achieve this goal. They believed that technology is useful and helpful for them, and would allow them to live safely and independently. These themes and their relationships are illustrated in Figure 1.

The above relationships among themes imply that older adults have primarily positive attitudes toward use of technological devices, and they believe that advanced technology will help them live safely and independently and achieve their goal of optimal aging. We have incorporated the themes of independence and safety in our conceptual model. Additionally, participants’ strong motivations to be safe and independent significantly influenced their perceptions and attitudes toward use of advanced technology. As mentioned above, in this research, motivation is a powerful factor influencing their attitudes toward use of technology. This is consistent with past studies. Schulz and Heckhausen (1996) mentioned the importance of motivation and cohort. They emphasized motivation as an important factor for older adults’ decision to use technology. We discuss this factor in more detail in the following conceptual model section.

Although the above themes are not generalizable due to the small sample size, they are useful for incorporating in a conceptual model on the role of gerotechnology in aging in place. The intent of this article was to identify concepts from the literature and pilot study data to facilitate the development of a conceptual model. We propose the following model for future research on perceptions and use of gerotechnology for optimal aging in place.

**CONCEPTUAL FRAMEWORK**

The objective of this conceptual model is to elucidate relationships between older adults’ use of gerotechnology and aging in place. This model is based on a combination of two theoretical perspectives: the congruence model of person-environment interaction (Kahana, 1982) and the life span theory of control (Heckhausen & Schulz, 1995; Schulz &
FIGURE 1. Themes and relationships from pilot study.
1a: Using communication technological devices helps older adults to contact people in order to receive physical support. 1b: Receiving immediate physical support leads to safety. 2a: Social interactions in the residential community help older adults to have emotional support. 2b: Providing emotional support to each other in the community leads to a feeling of safety. 3: There could be a relationship between use of technology and social interaction because use of technology may leads to social interactions; an arrow draws from use of technology to social interactions. However, in this diagram, the arrow is illustrated by a hidden line because it seems that participants in the focus group discussion did not discuss the merits or demerits of communicating with people through technological devices.

Heckhausen, 1996). Kahana’s congruence model (Figure 2-1) is utilized to explain person-environment interactions, and provides a foundation for a new model. The life span theory of control adds to the congruence model by clarifying the process of human behavior generation that is crucial for successful aging. Additionally, the concepts identified in the preliminary findings are incorporated in the model as they show potential outcomes when the use of gerotechnology as a compensatory mechanism is incorporated in the model.

In the following section, we briefly describe these two theoretical perspectives, and illustrate how they can be integrated and adapted to
FIGURE 2-1. The congruence model of person and environment interaction (adapted from Kahana, 1982).

![Diagram of the Congruence Model of Person-Environment Interaction]

A lack of Congruence between environment and individual needs

Congruence between environment and individual needs

demonstrate the compensating role of gerotechnology in person environment interaction for aging in place.

**Congruence Model of Person-Environment Interaction**

Cvitkovich and Wister (2001) outline two approaches to understand person-environment interactions, both of which are based on theoretical perspectives of Lewin (1935) and Murray (1938). These two approaches as: (1) the competence approach by Lawton and Nahemow, (1973) and (2) the P-E congruence approach by Kahana (1982) and Carp, and Carp (1984). On one hand, the competence approach proposes that human behaviors are determined by the relationships between the level of the individual’s
competence and the environmental demands. On the other hand, the congruence approach argues that human behaviors are outcomes of a match between the individual's needs and environmental demands. Kahana (1982) pointed out that the competence approach focuses exclusively on the relationships between negative environmental demands and passive adjustments of individuals. She emphasized positive aspects of person-environment relationships; individuals may be willing to change their environments and can improve the level of their competence (Cvitkovich & Wister, 2001).

According to Kahana's model, congruence between environmental situations and individual needs is important, especially for older adults who have limited environmental and individual options (Kahana, 1982). She highlighted the importance of environmental and individual differences, which affect the level of congruence. There are two dimensions of congruence: those based on environmental differences and those based on individual differences. For example, types of housing, such as individually owned houses, rental apartments, and long-term care facilities, differentially influence individual needs and the degree of fit between the environment and the individual needs. An example of individual differences is that personal characteristics, such as age, health status, level of functioning, ethnicity, Socioeconomic Status (SES), and experience, influence perceptions about their own abilities, health status, and their environments. Individuals interact with their environments based on their needs, perceptions, and preferences, and this interaction determines the level of congruence between the particular environment and the individual needs.

In this model, environment has two aspects: objective attributes and subjective assessments of the environment (Kahana, 1982). Objective attributes include physical, social, and organizational settings. Subjective assessments of the environment refer to perceptions toward the environment. The level of congruence is influenced by the relationships among objective attributes, perceptions, and individual needs and determines failure or success of the person-environment interactions. Congruence leads to success in person-environment interaction resulting in behavior/actions that foster independence and facilitate aging in place. Lack of congruence leads to failure in person-environment interaction and results in actions (or lack of action) that contributes to reduced independence and may eventually serve as a barrier to aging in place. However, the level of congruence for success or failure depends on individual perceptions (Kahana, 1982). Figure 2-1 provides a diagrammatic representation of this model.
Life Span Theory of Control

The Life Span Theory of Control (Figure 2-2) (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996) explains the selection and compensation process of successful human development. According to this theory, successful (optimal) development includes obtaining certain degrees of control (control environment “external to the individual”) throughout the life span (Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996). Motivation for control influences selection and compensation, as well as person-environment interactions. For example, if a person has high motivation for control, he/she will choose appropriate goals (selection) and, in case of failure in interactions with environments, find alternative ways, or compensations, to keep pursuing those goals. Interactions with the socio-spatial environment, which includes interactions with the built environment, family, community, society, and the larger culture, are all regulated and enforced by personal selections, as well as motivation. This means that people are
able to positively evaluate their competencies and have certain degrees of control in person-environment interactions. The two key elements of the model of successful development and regulation are selection and compensation. The use of gerotechnology can be placed under both the selection and compensation mechanisms; the person-environment interaction (and its success) may involve the use (selection) of gerotechnologies. Further, in case of failure, gerotechnologies can be used as a compensative mechanism for recovery and enhancement, as well as for increased behavioral competence.

**Conceptual Model of Gerotechnology as Compensatory Mechanism in Person Environment Interaction**

The following conceptual model (Figure 2-3) is proposed to show how gerotechnology can be a compensatory mechanism in the person environment interaction. This model integrates the lifespan theory of control and congruence model of person environment interaction and brings to the forefront the role of gerotechnology for aging in place.

The proposed conceptual model focuses on the compensation mechanisms that lead to the use of gerotechnology by older adults to fulfill deficiencies (decline in physical functioning and social relations). We argue that motivation is a powerful factor influencing attitudes toward the use of gerotechnology. In fact, Heckhausen and Schulz (1996) pointed out the importance of motivation and cohort factors for compensation mechanisms. Age, SES, personal history, perception of gerotechnology, and health are internal factors that could influence the decision to use gerotechnology. External factors considered in the model are cultural factors and interactions with caregivers.

Heckhausen and Schulz's life span theory of control (1995) highlights that if older adults have motivation to control their external environments, even if they have difficulty in person–environment interactions, they are willing to find ways to achieve their goals. This suggests a direct link to the use of gerotechnology. If they are successful in controlling their environments, their motivation increases, creating a positive loop for improving control and resiliency. This is consistent with the relationships of the four emergent themes from the pilot study discussed herein. The participants in the pilot study demonstrated that they were willing to use technology to achieve their goals, which included gaining safety and independence within their everyday environments. As the author of the congruence theory (Kahana, 1982) explains, older adults often want to have personal control
over their situations. For example, in the event of a fall, the individual can use a technological device to call for help immediately instead of waiting to be found. This type of control and flexibility helps older adults to be safe and independent in their preferred living environments.
Possible outcomes of using gerotechnology can be either negative or positive. An example of negative outcome is continual deterioration of health, mobility and independence in spite of using technology as a compensatory mechanism. This indicates that gerotechnology may not be the solution or compensatory mechanisms for all older adults. Additionally, some older adults may not be able to use gerotechnology properly and may not be motivated to compensate for their deficiencies. In those cases, their health and mobility may continue to deteriorate. One of the positive outcomes of use of gerotechnology is that it often helps in receiving direct support and improving social interactions. In this model, support is categorized as physical support and emotional support. However, gerotechnology must not be promoted as a replacement for the social and emotional support that results from direct interaction with family and friends, but as additional means of support. In this model, we take into account the contribution of direct interactions with family and friends that help older adults gain both physical and emotional support for their health and well being. Furthermore, this model illustrates that physical support often leads to functional recovery and enhancement, and in turn, leads to safety, resulting in behavioral competency. Emotional support enhances older adults’ independence, and independence encourages behavioral competency. Increases in behavioral competency results in success in terms of being able to aging in place as long as physical and/or cognitively possible. Also, these increases in competency often lead to the selection of higher-level goals for oneself. Higher-level goals contribute again to the person environment interaction, resulting in a positive loop for successful aging. This newly developed model shows that goal selection, person environment interaction, and use of gerotechnology are all part of a dynamic process that feeds into either a positive or negative loop.

This model provides a holistic perspective of the person environment interaction as it is mediated by the use of gerotechnology. It clarifies the decision making process involved in the selection and use of gerotechnology. It diagrammatically represents the relationships between several key concepts: person/environment interactions, compensation, and selection. Further, it provides a possible path for successful human development throughout the life span, especially for aging populations as they experience deficiencies because of declining health. Gerotechnology as a compensatory mechanism could be very helpful for older adults as they try to age in place, and may enhance their health and psychological wellbeing resulting in successful aging. In order to introduce the use of gerotechnology to older adults, it is important to have an understanding of older
adults’ willingness to accept and use gerotechnologies, factors that influence their decisions, and ways in which these factors influence their decisions. This model may serve as a foundation to guide future research on gerotechnology role in successful aging in place.1

NOTE

1. Currently, about 30% of 65-and-over population lives alone, and this percentage is going to continue to increase.

REFERENCES


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